CELLULAR POSITIONING BY LOCATION FINGERPRINTING WITH THE AID OF PROPAGATION MODELS

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Abstract

The Fingerprinting method or the Database Correlation Method (DCM) is a network based positioning technique which has shown superior accuracy. DCM is based on a pre-measured database of location dependent variables such as Received Signal Strength (RSS). The major challenge of the technique is the effort involved in forming the database, which prevents it being deployed in large, dynamic networks.

The work presented in this thesis investigates the possibility of using network planning tool predictions instead of field measurements to create the fingerprint database for DCM. While the accuracy of this approach is lower than the DCM method with field measurements, further tuning of the predictions in order to improve the performance is proposed. The tuning method is defined as cell-wise calibration, which calibrates the predictions by using a lesser number of field measurements in a cell-by-cell basis. In addition, a novel fingerprint filtering approach and a fingerprint matching technique (a cost function) are proposed.

The trial results show that, the performance of DCM using the proposed database is inferior to that using a measured database. However, the application of calibration process for predictions improves the performance up to an acceptable level. The calibration method, designed for the bad urban scenario is based on curve fitting whereas that for urban, suburban and rural environments is based on neural networks. In addition, the novel fingerprint filtering approach is robust for the bad urban environment while the novel cost function shows higher performance with the proposed database.

The best positioning accuracy for the. bad urban environment is 200m in 80% of the estimates and that for the urban environment is 125m (80%). Remarkable performance improvement can be observed in the rural environment giving a positioning error less than 385m in 80% of the estimates. The performance in

suburban environment is inferior to that-in both urban and rural, with an error less than 550m in 80% of the time.

The proposed solution for positioning is best suited for the deployment in large dynamic networks as a network-based method to provide basic information services, such as nearest ATM machine, petrol. station or hospital, traffic information and location based advertising.